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ROSA Successful TRL-9 Spaceflight Demonstration

Deployable Space Systems, Inc. (DSS) of Santa Barbara, CA, announces the successful completion of the TRL-9 spaceflight demonstration of the patented and multiple award-winning **R**oll-**O**ut **S**olar **A**rray (ROSA). The ROSA solar array spaceflight mission was performed on the International Space Station (ISS), concluding on Monday, 26 June 2017, following launch to ISS aboard NASA's 11th Commercial Resupply Mission, and successful execution of a 7-day long flight demonstration. 100% of the mission objectives were achieved, including: functional deployment and kinematics, deployed dynamics behavior verification, photovoltaic power production and survivability, thermal snap / dimensional stability characterization, and retraction capabilities. A photograph of the TRL-9 ROSA solar array deployed on ISS is shown below.

The TRL-9 ROSA spaceflight validation achievements include the following milestones:

1) Successful functional deployment in the space environment and correlation with analytical models.

    a. ROSA deployment was 100% nominal - completely unrolling within seconds of the predicted deployment time. Deployment was powered completely by the strain energy of the composite booms - validating expected deployment margin performance in the space environment without the need for motors or complex mechanisms.

    b. ROSA was successfully deployed four times throughout the mission, with repeatable nominal performance, and zero anomalies.

2) Successful functional wing retraction in the space environment.

    a. ROSA was completely retracted three times throughout the mission to demonstrate key resiliency features for threat avoidance. Each of three wing retractions showed nominal performance, high repeatability and no anomalies.

    b. The three successful retraction and re-deployment events proved the additional robustness and repeatability of the rollable booms, mechanisms, and active solar cell strings (where no power degradation was observed throughout the multiple on-orbit deploy/retract cycles).

3) Thermal-snap / dimensional stability of the wing when entering and exiting eclipses was investigated, yielding superb dimensional stability results (zero measurable thermally-induced motion) throughout all thermal exposures.

4) Structural deployed dynamics were measured (bending and blanket modes) using sensor and photographic techniques, showing wing performance within analytical model predictions.

5) I-V curves for multiple SolAero ZTJ, Spectrolab XTJ, and Northrop Grumman ZTJ photovoltaic/PV strings were measured showing nominal performance and no power loss throughout the mission following launch, deployment, several hundred orbits and multiple retract/deployment cycles.

Following 100% completion of all science objectives, there were two pre-planned disposal methods for ROSA: 1) Re-stowage into the Dragon trunk, or 2) Controlled jettison using a spring-loaded ejection mechanism. Redundant latching of the stowed wing was an additional (non-ROSA-related) function for meeting ISS safety requirements for re-stowage into the Dragon trunk. However, after multiple attempts, a slight but repeatable misalignment prevented the wing from fully latching upon retraction. Due to time constraints and other needs for the ISS robotic arm, additional retraction attempts were not performed. The mission concluded when NASA performed the pre-planned backup disposal method of a controlled jettison of ROSA, providing a spectacular grand-finale to a successful ROSA mission.

The ROSA demonstration mission completed 100% of the science objectives: Deployment and retraction was successfully demonstrated (multiple times), structural dynamic performance was characterized against analysis predictions, and solar cell performance was measured showing no power loss. ROSA has now achieved a technical readiness level classification of 9 (TRL-9) and is ready to power all space missions needing the highest solar array performance and reliability, at the lowest cost.

General ROSA Background: The patented ROSA solar array technology developed by DSS (shown below) is a new and innovative mission-enabling rolled flexible blanket solar array system that offers greatly improved performance over conventional rigid panel solar arrays and other state-of-the-art solar arrays, as well as greater affordability for use on future NASA, Air Force, and commercial space missions. The DSS ROSA solar array features an innovative "roll out" design which uses composite booms to serve as both the primary structural elements and the deployment actuator, and a modular photovoltaic blanket assembly that can be configured into a multitude of solar array architectures. The stored strain energy of the booms enforces the unrolling deployment actuation, and when fully deployed the rigid booms provide the solar arrays' structural stiffness and strength. The ROSA technology achieves this simplicity without the use of complex mechanisms, intricate hinges or expensive motors/controllers typically associated with other competing solar array technologies. The ROSA solar array, when configured for launch, stows into a compact cylindrical volume yielding efficient space utilization. The unique ROSA stowed configuration is able to allow extremely large solar array deployed areas to be stowed very compactly for packaging within launch vehicles because its solar cells are mounted on an innovative rollable modular flexible blanket which is much thinner than traditional rigid panel solar arrays currently in use. Space Systems Loral (SSL) of Palo Alto, California is currently flight-qualifying and implementing DSS's ROSA technology onto SSL's heritage commercial satellite platform, enabling higher spacecraft power, enhanced payload capability, and improved solar array performance and affordability. ROSA is also currently being implemented on two proprietary flight programs, and is baseline on numerous proposed missions.

For additional information on the ROSA solar array and the ISS ROSA demonstration mission please contact: Mr. Brian Spence, Mr. Steve White, or Mr. Matt LaPointe at Deployable Space Systems.

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